

# INITIAL EXPERIENCES WITH THREE RENAL ARTERIES OF KIDNEY ALLOGRAFT IN KIDNEY TRANSPLANTATION: A CASE SERIES

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## ABSTRACT

**Objective:** This study reported a case series of our initial experiences in kidney transplantation with three renal arteries of the kidney allograft. **Material & methods:** The kidney allograft from all of the four cases was harvested with laparoscopic living donor nephrectomy. End-to-side anastomosis was performed from the small artery to the larger main artery before side-to-side anastomosis was performed between the two arteries of equal size. After joining the renal arteries we performed end-to-side anastomosis from the renal vein and artery to the external iliac vein and artery respectively. **Results:** All of the four cases respond well to the allograft kidney. Three recipients had normal serum creatinine level before 5 days after transplantation. One recipient had undergone hemodialysis once on the third day after transplantation. All of the recipients have no vascular and urologic complications. **Conclusion:** Multiple renal arteries are no longer considered as a relative contraindication, especially with meticulous anastomosis technique. No vascular and urologic complication was observed from this technique.

**Keywords:** Renal arteries, transplant, allograft, kidney.

## ABSTRAK

**Tujuan:** Studi ini melaporkan pengalaman awal kami dalam transplantasi ginjal dengan tiga arteri ginjal dari allograft ginjal. **Bahan & cara:** Allograft ginjal dari seluruh 4 kasus transplantasi yang kami tangani didapatkan melalui tindakan Laparoscopic Living Donor Nephrectomy. End-to-side anastomosis dilakukan pada arteri terkecil ke arteri yang lebih besar sebelum arteri tersebut dianastomosis secara side-to-side ke arteri renalis yang berukuran sama. Setelah menggabungkan arteri renalis menjadi satu, kami melakukan end-to-side anastomosis dari vena dan arteri renalis ke vena dan arteri iliaka eksterna. **Hasil:** Seluruh kasus yang kami tangani merespon baik terhadap allograft ginjal. Tiga resipien mencapai kadar serum kreatinin yang normal sebelum 5 hari paska transplantasi ginjal. Meski demikian, 1 pasien harus menjalani hemodialisa sekali dalam 3 hari paska transplantasi ginjal. Semua pasien resipien tidak mengalami komplikasi baik pada bidang vaskular maupun urologi. **Simpulan:** Arteri multipel pada ginjal tidak lagi dianggap sebagai kontraindikasi relatif, terutama dengan teknik anastomosis yang teliti. Tidak ada komplikasi pada bidang vaskular maupun urologi yang ditemukan dari teknik ini.

**Kata kunci:** Arteri multipel ginjal, transplantasi, allograft, ginjal.

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## INTRODUCTION

The increasing incidence of metabolic disease resulting in increased incidence of End Stage Renal Disease (ESRD) which requires renal replacement therapy (RRT) in the form of kidney transplantation, hemodialysis, or peritoneal dialysis. As the RRT with the lowest mortality and morbidity

with a better quality of life, kidney transplantation has been routinely performed in Indonesia.<sup>1</sup>

Since the first laparoscopic donor nephrectomy performed in Indonesia in 2011, until now Cipto Mangunkusumo Hospital had been performing more than 250 kidney transplantations. One of the biggest challenges in performing kidney transplantation is the presence of multiple renal

arteries (MRA) of the kidney allograft that has been associated with vascular and post-operative urologic complications, also long-term function of the kidney.<sup>2</sup>

## OBJECTIVE

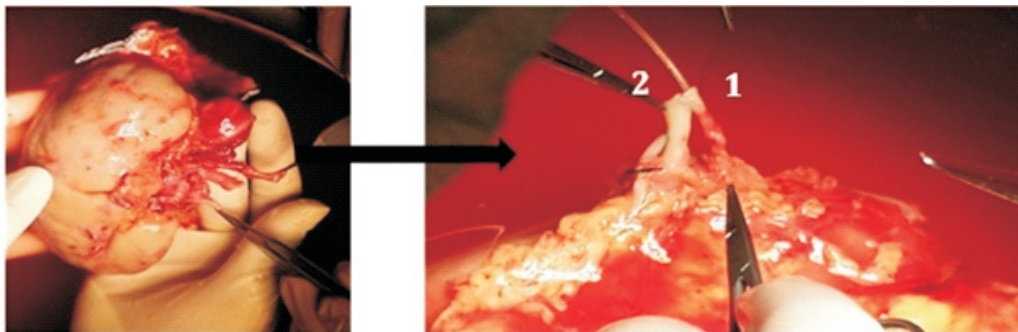
This paper reported a case series of our initial experiences in kidney transplantation with three renal arteries of the kidney allograft.

## MATERIAL & METHOD

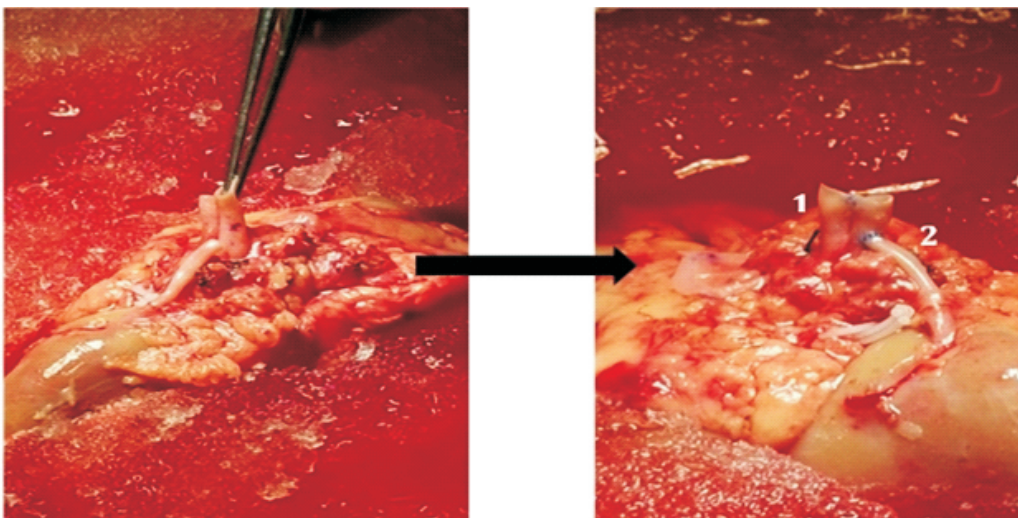
The first living kidney donor is a 51-year-old male without any contraindication to undergo kidney donor procedure. Pre-operative CT-angiography was conducted and three left kidney renal arteries were found, originating from the aorta, each of the arteries was 5 mm, 2.5 mm, and 2 mm in

diameter. Neither of those three have any vascular malformations, thrombus, or stenosis. Two renal arteries were found on the right kidney, both branched distally after the inferior vena cava, with 5 mm and 3 mm in diameter of each one. No vascular malformations, thrombus, or stenosis were found either. The left kidney was chosen as the donor kidney from the multidisciplinary discussion that had been conducted prior to the transplantation procedure.

The first recipient, with a body mass index 33.5 kg/m<sup>2</sup>, is a 63-year-old female who suffered ESRD due to nephropathy diabetic. She had been undergoing hemodialysis since 1.5 years prior to transplantation with daily urine output about 200 ml/day. Recipient and donor both share the same O blood type with Rhesus (+). There was 30% of cell lysis from the result that was obtained from the crossmatch evaluation test.



**Figure 1.** Side to side anastomosis between two largest size of renal arteries (1) and end to side renal anastomosis between smallest artery and the largest renal artery (2), the aim of the anastomosis is to make a single lumen of renal artery allograft.



**Figure 2.** Side to side anastomosis between two largest size of renal arteries (1) and end to side renal anastomosis between smallest artery and the largest renal artery (2), the aim of the anastomosis is to make a single lumen of renal artery allograft.

The second living kidney donor is a 43-year-old male without any contraindication to undergo kidney donor procedure. Pre-operative CT-angiography was conducted and three left kidney renal arteries were found, originating from the aorta, each of the arteries was 6.3 mm, 6 mm, and 5.5 mm in diameter. Neither of those three have any vascular malformations, thrombus, or stenosis. Two renal arteries were found on the right kidney, both branched after passing through the inferior vena cava, with 6.4 mm and 5.5 mm diameter of each one. No vascular malformations, thrombus, or stenosis were found either. The left kidney was chosen as the donor kidney from the multidisciplinary discussion that had been conducted prior to the transplantation procedure.

The second recipient, with a body mass index  $23.7 \text{ kg/m}^2$ , is a 66-year-old male who suffered ESRD due to hypertension. He had been undergoing hemodialysis since 4 months prior to transplantation with daily urine output about 600 ml/day. Recipient and donor both shares the same O blood type with Rhesus (+). There was 20-30% of cell lysis from the result that was obtained from the crossmatch evaluation test.

The third living kidney donor is a 25-year-old male without any contraindication to undergo kidney donor procedure. Pre-operative CT-angiography was conducted and three left kidney renal arteries were found, originating from the aorta, each of the arteries was 6.3 mm, 2.9 mm, and 2.3 mm in diameter. Neither of those three have any vascular malformations, thrombus, or stenosis. Two renal arteries were found on the right kidney, both branched after passing through the inferior vena cava, with 6.5 mm and 2.9 mm in diameter of each one. No vascular malformations, thrombus, or stenosis were found either. The left kidney was chosen as the donor kidney from the multidisciplinary

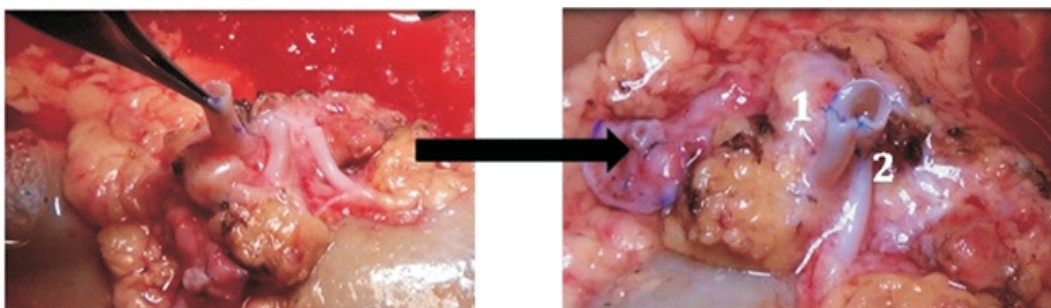
nary discussion that had been conducted prior to the transplantation procedure.

The third recipient, with a body mass index  $16.9 \text{ kg/m}^2$ , is a 63-year-old female who suffered ESRD due to nephrotoxic drug. She had been undergoing hemodialysis since 2 months prior to transplantation with daily urine output less than 100 ml/day. Recipient and donor both share the same B blood type with Rhesus (+). There was 10-20% of cell lysis from the result that was obtained from the crossmatch evaluation test.

The fourth living kidney donor is the sibling of the recipient, a 46-year-old male, without any contraindications to undergo kidney donor procedure. Pre-operative CT-angiography was conducted and three left kidney renal arteries were found, originating from the aorta, each of the arteries was 5.9 mm, 3.8 mm, and 3 mm in diameter. Neither of those three have any vascular malformations, thrombus, or stenosis. One renal artery was found on the right kidney with 6 mm in diameter which branched behind the inferior vena cava. No vascular malformations, thrombus, or stenosis were found either. The left kidney was chosen as the donor kidney from the multidisciplinary discussion that had been conducted prior to the transplantation procedure.

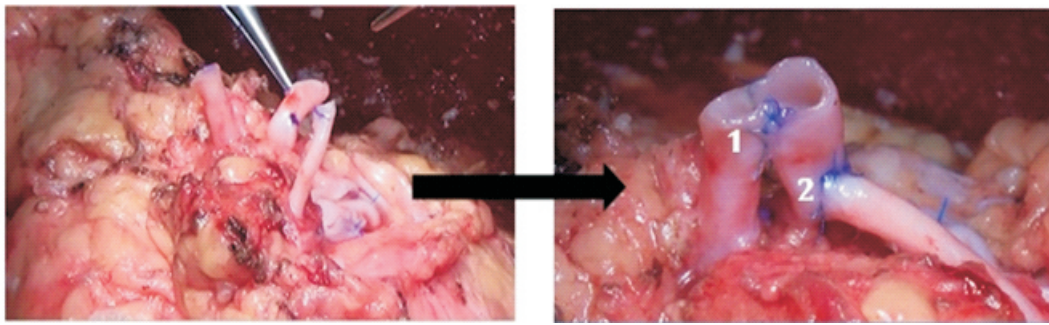
The fourth recipient, with a body mass index  $21.9 \text{ kg/m}^2$ , is a 49-year-old male who suffered ESRD due to nephropathy diabetic. The patient had been undergoing hemodialysis since 6 months prior to transplantation with a maximal daily urine output up to 1000 ml/day. Recipient and donor both shares the same A blood type with Rhesus (+). There was 10-20% of cell lysis from the result that was obtained from the crossmatch evaluation test.

All the four donor kidneys in this series were harvested with laparoscopic procedure. The three renal arteries of the left kidney were preserved from



**Figure 3.** Side to side anastomosis between two largest size of renal arteries (1) and end to side renal anastomosis between smallest artery and the largest renal artery (2), the end point of the anastomosis is to make a single lumen of renal artery allograft.





**Figure 4.** Side to side anastomosis between two largest size of renal arteries (1) and end to side renal anastomosis between smallest artery and the largest renal artery (2), the aim of the anastomosis is to make a single lumen of renal artery allograft.

surrounding tissues and were ligated and cutted as close as possible to the aorta. Before the clipping procedure of the renal artery was performed, 100 IU/kg heparin was injected to the donor's kidney. As soon as the kidney been out from the donor's body, it was irrigated with 1 liter of custodiol containing 20 mg of Herbesser.

In all four recipients, kidney allograft was placed in the right iliac fossa. End-to-side anastomosis between external iliac artery and the renal artery of kidney allograft was performed. The same procedure was implemented to the external iliac vein and the renal vein of the kidney allograft. Before the anastomosis was performed, the three renal arteries of the kidney allograft were prepared and joined to create a single artery. End-to-side anastomosis was performed from the smallest and the furthest artery to the larger main renal artery before side-to-side anastomosis was performed between the two largest renal arteries of equal size.

## RESULTS

First case showed that the serum creatinine level pre-transplantation was 8.97 mg/dL. The number decreased to 1.6 mg/dL in 2 weeks post transplantation. Urine production in the first day after transplantation was 2050 ml, but dropped until 364 ml on the second day. Hemodialysis was conducted on the third day, and after 3 times on Hemodialysis, daily urine production were back to exceed 2000 ml. Recipient was hospitalized for 6 days and discharged without any surgical complications.

In the second case, pre-transplantation serum creatinine level was 8.97 mg/dL. The number decreased to 0.6 mg/dL in 4 days post transplantation. Urine production in the first day post transplan-

tation was 11.250 ml. However the polyuria diminished in four days. Recipient was hospitalized for 5 days and discharged without any surgical complications.

In the third case, the serum creatinine level prior to the transplantation was 4.8 mg/dL. The number decreased to 0.5 mg/dL in three days post transplantation. The urine production was ranged between 2000-4700 ml per day after the transplantation procedure. There was a cardiovascular complication on the fifth day in the form of ischemic stroke. The family of the patient decided to transfer the patient to another hospital. Recipient was transferred on the seventh day with serum creatinine level was 0.5 mg/dL and without any surgical complications.

In the fourth case, the serum creatinine level prior to the transplantation was 4 mg/dL. The number decreased to 1 mg/dL in 2 days post transplantation. The daily urine production was ranged between 4000-6000 ml. Recipient was hospitalized for 5 days and discharged without any surgical complications.

## DISCUSSION

The first successful kidney transplantation in human was performed between twin brothers in Boston, USA, by Murray.<sup>3</sup> Since then, kidney transplantation was the RRT treatment of choice for ESRD due to long-term satisfying results and a better quality of life in comparison with dialysis.<sup>4</sup>

Until now, multiple renal arteries of the kidney allograft still becomes a relative contra-indication and avoided in some transplant centers due to the incidence of vascular and urologic complications.<sup>5</sup> Many studies in transplantation centers tried to find out whether there were significant



differences in renal transplantation with multiple renal arteries (MRA) compared to single renal artery (SRA).

Majority of the studies in kidney transplantation centers comparing the short-term and long-term outcomes, also the vascular and urologic complication of kidney transplantation with MRA and SRA. The parameter of both short-term and long-term results that had been measured in various studies include post-transplant serum creatinine level, period of hospitalization, renal allograft survival, and patient mortality rate. Most common post-transplantation complications are acute tubular necrosis (ATN), urologic complications, and vascular complications.

Post-transplantation serum creatinine level in both SRA and MRA group showed no significant differences in short-term and long-term observation.<sup>6-18</sup> Both groups also showed no significant difference in hospitalization period.<sup>5,15</sup> The graft survival showed no significant differences in both groups.<sup>6-18</sup> Complications after kidney transplantation in the form of ATN in both groups also did not differ significantly,<sup>6,10,13</sup> however, multicenter study in the United Kingdom and Pakistan indicated that there were significant differences between the two groups, where MRA group showed higher ATN incidence.<sup>18</sup> There were no significant difference in post-transplantation surgical complications such as urologic complications between the two groups.<sup>6,8,10-13,15-19</sup>

Post-transplant vascular complications in various studies also showed no significant difference,<sup>5,6,8,10-13,15,18</sup> except for the study in Minnesota and Kuwait which showed that the donor's kidney with MRA had the higher risk of renal artery stenosis.<sup>7,16</sup>

The initial experiences of MRA anastomosis in kidney transplantation at our center showed similar results with various transplant centers worldwide, with post-transplant serum creatinine values, hospitalization period, patient and graft survival and short-term surgical complications were no different from the SRA group.

## CONCLUSION

Vascular and urologic complications of multiple renal arteries anastomosis was not occurred in this case series. With meticulous anastomosis technique, the multiple renal arteries are no longer considered as a relative contraindication of kidney transplantation.

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